

X

1608/4901

TO THE RIGHT HONOURABLE

WILLIAM WINDHAM

A

REGISTER

OF

ONE of Mr. MUDGE's

TIME-KEEPERS.



1608/4901

TO THE (RIGHT) HONOURABLE

WILLIAM WINDHAM.

S I R,

TO you, who with no less ability than success, have supported Mr. Mudge's application to Parliament, some further documents of the merits of his Timekeepers, will, I flatter myself, not be unacceptable, nor will they appear uninteresting to any impartial reader, when he is told, that the Timekeeper, whose motion I have observed by frequent transits of the sun during thirteen months, has not been cleaned since the beginning of 1789. From the commencement of Mr. Mudge's business before Parliament, to its final termination, you have placed an uninterrupted confidence in me, which I am as proud of, as I now feel happy in availing myself of this opportunity to thank you for it.

I have often wondered, that a passage* which I have extracted from a small tract of

Mr.

* The force derived from the mainspring, should be made as equal as possible, by making the mainspring wind up another



Mr. Mudge's, printed in 1763, has not led to the discovery of his valuable invention, long before you saved it for the benefit of the public, in which you will perceive that great artist clearly points out his incomparable Scapement, and yet, thirty-one years have elapsed without producing a single instance of a mechanic endowed with a sufficient share of penetration to profit by *so broad a hint*; surely, Sir, Genius is a scarce plant, and those who either obstruct its growth, or blast the fruit it bears, cannot be actuated by quite unexceptionable motives,

The full and judicious investigation which the Select Committee have bestowed upon the subject of Timekeepers, the elucidation which it has derived from their labour, and the excellent report which you have drawn up of their proceedings, with that perspicuity, acuteness, and elegance for which you

ther smaller spring at a less distance from the balance, at short intervals of time. *I think it would not be impracticable to make it wind up at every vibration, a small spring similar to the pendulum spring, that should immediately act on the balance, by which the whole force acting on the balance would be reduced to the greatest simplicity, with this advantage, that the force would increase in proportion to the arch.*

are

are conspicuous, must exclude from it for ever that obscurity, confusion, and intricacy in which an irreconcilable diversity of opinions on the topic of calculating rates had involved it. The general and fundamental principle on which every calculation of that sort ought to be made, being now clearly understood, which is simply to obtain thereby a mean rate to which a watch is most likely to conform hereafter, there is every reason to hope that, whenever by the application of other artists, many more of those excellent machines are made, (of which there is now a near prospect, by the joint abilities of Messrs. Howells and Pennington, who for some months past have been engaged by Mr. Mudge, jun. in constructing Timekeepers after the model of those of his father;) their use by judicious observers will be productive of many important advantages both at sea and at land.

I am,

With great respect,

Your most humble

And obedient Servant,

Count de Brühl,

DESCRIPTION
OF
THE SCAPEMENT

Mr. Mudge's first Timekeeper,

Drawn up in August, 1771.

MR. MUDGE's Timekeeper has five wheels, with numbers high enough to admit pinions of twelve, and yet to go eight days. The Scapement consists of a wheel almost like that of a common crown wheel, and acts on pallets, each of which has a separate axis lying in the same line: To each pallet a spring is fixed in the shape of a pendulum spring; these springs are wound up alternately by the action of the last wheel upon the pallets,

lets, which is performed in the following manner:—Whenever one of the pallets (for instance the upper one) is set in motion by a tooth of the wheel sliding upon it, and then resting against a hook, or, rather a baring at its end, the balance is entirely detached from it, being then employed in carrying the other pallet the contrary way: When the balance returns from that vibration, (partly by the force of the pendulum spring, and partly by that of one of the two small springs which it had bent by the motion of that pallet which it had carried along with itself) it lays hold of the upper pallet and carries it round in the same manner as it did before the lower one, and, of course, in the same direction which the upper pallet had received from the power of the main spring at the time that it was quite unconnected with the balance. The communication of motion from the balance to the pallets, and vice versa, is effected by two pins fixed to a crank, which in following the balance, hit each its proper pallet alternately. By what has been said,

it

it is evident that whatever inequality there may be in the power derived from the main spring, (provided the latter be sufficient to wind up those little pallet springs) it can never interfere with the regularity of the balance's motion, but at the instant of unlocking the pallets, which is so instantaneous an operation*, and the resistance so exceedingly small, that it cannot possibly amount to any sensible error. The removal of this great obstacle was certainly never so effectually done by any other contrivance, and deserves the highest commendation, as a probable means to perfect a portable machine that will measure time correctly. But this is not the only, nor, indeed, the principal advantage which this Timekeeper will possess over any other; for, as it is impossible to reduce friction to so small a quantity as not

* In a very ingenious paper of Mr. Atwood, called, Investigations founded on the Theory of Motion for determining the Times of Vibrations of Watch Balances, the Author expresses that portion of time during which the balance is connected with the other parts of the machine, by $\frac{1}{1000000}$.

to affect the motion of a balance, the consequence of which is, that it describes sometimes greater and sometimes smaller arcs, it became necessary to think of some method by which the balance might be brought to describe those different arcs in the same time. If a balance could be made to vibrate without friction or resistance from the medium in which it moves, the mere expanding and contracting of the pendulum spring, would probably produce the so much wished for effect, as its force is supposed to be proportional to the arcs described; but as there is no machine void of friction, and as from that cause, the velocity of every balance decreases more rapidly than the spaces gone through decrease, this inequality could only be removed by a force acting on the balance, which assuming different ratios in its different stages, could counter-balance that inequality. This very material and important remedy, Mr. Mudge has effected by the construction of his Scapement; for his pallet springs having a force capable of being encreased almost
at

at pleasure, at the commencement of every vibration, the proportion in their different degrees of tension, may be altered till it answers the intended purpose. This shews how effectually Mr. Mudge's Scapement removes the two greatest difficulties that have hitherto baffled the attempts of every other artist, namely, the inequalities of the power derived from the main spring, and the irregularities arising from friction, and the variable resistance of the medium in which the balance moves. Although at the time I am writing this account of his invention, the machine is not yet finished†; I am not the less confident that whenever it is, it will be found to be one of the most useful of any which have as yet appeared.

† It was not completed till two years after the date of this sketch

REGISTER of the TIMEKEEPER called Blue, from the day after that on which this and another called Green, were brought to Dover-street, and the latter taken to pieces, for the inspection of the Commissioners appointed by the House of Commons.

Year & Month.	Days.	Difference from mean time at Noon.	Daily Rate.	Therm.	Mean time from meridian	Difference	Therm.
1793.							
May.	○ 12	3.56,06			74.52.0	9 6	
	D 13	3.57,33	+1,27		84.42.0	01 8	
	8 21	4. 8,6	1,409		71.52.0	11 7	
	4 23	4.15,15	3,775		1.0.1	11 8	
	12 30	4.29,93	2,111		12.5.1	13 6	
June.	h 1	4.35,14	2,605		1.8.1	21 6	
	8 4	4.40,55	1,800		88.0.1	21 8	
	D 10	4.50,97	1,737		80.81.1	01 9	
	8 12	4.55,1	2,065		47.75.1	25 8	
	h 15	5. 1,1	2,0		82.05.1	25 9	
	○ 16	5. 3,45	2,35		88.52.1	25 6	
	D 17	5. 5,04	1,59		80.12.1	05 8	
	8 21	0. 8,35			80.81.1	01 9	
	8 26	0.19,39	2,208		70.08.1	8 8	
	12 27	0.22,07	2,68		40.14.1	2 6	
	h 29	0.27,47	2,7		02.54.1	3 6	
July.	8 3	0.37,2	2,432		28.54.1	7 8	
	8 5	0.41,37	2,085		7.54.1	9 9	
	○ 7	0.46,67	2,67		12.1		

Down at 11 h. 26 m. having omitted to wind it up on the preceding day.

First observation at Harefield, reduced to the meridian of Dover-street, 1° 21' 9" by 1° 21' 9" for their difference.



Year & Month. 1793.	Days.	Difference from mean time at Noon.	Daily Rate.	Ther ^m .	
	D 8	0.50,2	3,53	78 5	
	♂ 9	0.52,47	2,27	74	
	♀ 10	0.54,48	2,01	79	
	♂ 11	0.57,17	2,69	79 5	
	♀ 12	1. 0,1	2,93	80	
	h 13	1. 2,51	2,41	80	
	D 15	1. 8,1	2,793	79	
	♂ 16	1. 9,38	1,28	81	36° between 3 & 4 in Harefield Observatory.
	♀ 19	1.18,63	3,083	66	In Dover-street.
	♂ 25	1.27,74	1,52	70	
	♀ 26	1.29,26	1,52	71	
	D 29	1.32,38	1,04	60	
	♂ 30	1.34,02	1,64	65	
August	♀ 2	1.38,2	1,393	69	In Dover-street.
	h 3	1.39,97	1,77	75	Harefield.
	D 5	1.41,04	0,535	67	
	♂ 6	1.42,29	1,25	66	
	♀ 7	1.42,85	0,56	66	
	♀ 9	1.43,7	0,425	63	
	D 12	1.46,17	0,825	66	
	♂ 13	1.47,68	1,51	76	

Year & Month. 1793.	Days.	Difference from mean time at Noon.	Daily Rates.	Therm.	
	♀ 14	1.48,5	0,82	70	In Dover-street.
	♀ 16	1.50,69	1,095	65	In ditto.
	♂ 20	1.52,59	0,475	66	Harefield.
	♀ 21	1.53,05	0,46	71	
	♂ 22	1.53,56	0,51	69	
Sept.	♀ 6	1.49,65	+0,36	63	
	♂ 8	1.48,35	0,65	62 4	
	♂ 15	1.42,36	0,856	67 0	
	♂ 16	1.43,16	+0,8	64	
	♂ 24	1.38,9	+0,533	53	
	♀ 26	1.38,26	0,32	64	In Dover-street
	♀ 27	1.38,12	0,14	60	In ditto
	♀ 28	1.37,51	0,61	58	} with fire in the chimney.
	♂ 30	1.37,02	0,245	55	
Octob.	♀ 4	1.35,79	0,307	58	
	♂ 7	1.34,49	0,433	58	
	♂ 10	1.33,3	0,397	62	In Dover-street.
	♂ 21	1.25,13	0,743	60	Ditto.
	♂ 28	1.23,2	0,276	62	Ditto.
	♀ 30	1.20,3	1,45	61	Ditto.
	♂ 31	1.19,47	0,83	57	Ditto.

Year & Month. 1793.	Days.	Difference from mean time at Noon.	Daily Rate.	Therm. °	
Nov.	♂ 5	+1.26,14	+1.334	50	
	♀ 6	1.28,3	2,16	48	
	☉ 10	1.26,81	-0,355	60	By ♀ Aquilæ in Dover-st.
	☽ 11	1.27,43	+0,804	58	By ☉ in ditto.
	♂ 19	1.40,15	1,59	52	Harefield.
	♀ 23	1.32,1	-2,012	49	
Decem.	☉ 8	1.35,57	0,231	50	In Dover-street.
	♂ 19	1.35,12	-0,04	61	Down the 20th; all the following observations, excepting those over against which the places are mentioned, were made in Dover-street.
	♀ 21	-0.15,6		61 5	
	☉ 22	0. 0,33	+1,23	61 0	
	☽ 23	0. 0,4	-0,07	61 0	
	☉ 29	+0.1,5	+0,317	60 0	Carried the Timekeeper into the Observatory, where the Therm. stood at 32°. 5.
1794. Janua.	♂ 31	0. 6,65	2,572	41 0	
	♀ 1	0. 8,76	2,11	31	
	♂ 7	5. 8,7	16,4	32	By observations of the Duke of Marlborough, at Blenheim, west of Dover-street, 4° 50' 1.
	♂ 9	5.15,7	3,5	24	
	♂ 16	0.37,1	1,614	38	
	☽ 20	0.39,35	0,563	46	
	♂ 21	0.39,5	0,15	43	
	♀ 22	0.39,9	0,4	47	
	♀ 24	0.40,2	0,15	41 5	

Year & Month. 1794.	Days.	Difference from mean time at Noon.	Daily Rate.	Therm. °	Time from noon to wound Difference	Place	Wound
	☉ 26	0.41,7	0,75	31.5			
Feb.	h 1	0.47,5	0,967	32.0			
	☉ 2	0.48,5	1,00	52.0			
	D 3	0.49,1	0,6	52.1			
	♀ 5	0.49,5	0,2	50.0			
	☉ 9	0.52,2	0,925	51.1			
	D 10	0.52,5	0,3	46.1	At Harefield.		
	♀ 14	0.55,7	0,8	57.0	In Dover-street.		
	h 15	0.55,5	0,2	58.0			
	☉ 23	1. 2,0	+0,812	64.0			
	♀ 26	1. 5,4	1,133	50.0			
March.	h 1	1. 7,7	0,767	47.0	Down at 11h. 30'. wound		
	♀ 7	0. 0,1			up at 22h. 30'.		
	h 8	0. 1,6	1,5	58.0			
	h 13	0. 5,9	0,86	54.0			
	D 17	0.10,55	1,162	58.0			
	h 22	0.15,0	0,89	56.0			
	☉ 23	0.15,4	0,4	58.0			
	♀ 28	0.18,8	0,64	47.0			
April.	h 5	0.26,5	0,963	62.0			
	♂ 8	0.28,85	0,75	63.0			

Year & Month. 1794.	Days.	Difference from mean Time at Noon.	Daily Rate.	Therm. °	MOON TIME IN HOURS AND MINUTES	Days	MOON TIME IN HOURS AND MINUTES
	14	0.34,8	0,992	63.0	7.14.0	ds 0	
	♂ 15	0.35,75	0,95	63.0	7.14.0	1 8	Feb
	♀ 16	0.36,6	0,55	63.0	7.14.0	2 0	
	h 19	0.38,1	1,167	60.5	At Harefield.		
	♂ 22	0.39,1	0,33	63.0	In Dover-street.		
	♀ 23	0.40,8	1,7	63.0	7.22.0	2 0	
	h 24	0.42,1	1,3	62.0	7.22.0	10 0	
	♀ 25	0.42,3	0,2	63.0	7.22.0	11 2	
	⊙ 27	0.41,1	0,6	73.0	7.22.0	21 8	
	D 28	0.40,9	0,2	63.0	7.22.0	22 0	
May.	h 3	0.42,65	+0,35	65.1	7.22.0	ds 8	
	h 10	0.44,75	0,3	61.0	7.22.0	1 8	March
	⊙ 11	0.45,1	0,35	61.5	7.22.0	2 2	
	♀ 14	0.48,55	1,15	62.5	7.22.0	8 8	
	h 15	0.49,1	0,55	64.5	7.22.0	13 10	
	♀ 16	0.49,5	0,482	66.1	7.22.0	17 10	
	♀ 23	0.54,3	0,686	63.8	7.22.0	25 8	
June.	D 2	1. 1,9	0,76	63.5	7.22.0	25 0	
	⊙ 8	1. 8,1	1,02	62.0	7.22.0	28 2	
	♂ 10	1.10,3	1,1	64.0	7.22.0	2 8	April
	♀ 13	1.12,1	0,6	66.0	7.22.0	8 8	

(12)

Year	Month	Day	Time	Place	Remarks
1871	1	1	10.00	10.00	10.00
1871	1	2	10.00	10.00	10.00
1871	1	3	10.00	10.00	10.00
1871	1	4	10.00	10.00	10.00
1871	1	5	10.00	10.00	10.00
1871	1	6	10.00	10.00	10.00
1871	1	7	10.00	10.00	10.00
1871	1	8	10.00	10.00	10.00
1871	1	9	10.00	10.00	10.00
1871	1	10	10.00	10.00	10.00
1871	1	11	10.00	10.00	10.00
1871	1	12	10.00	10.00	10.00
1871	1	13	10.00	10.00	10.00
1871	1	14	10.00	10.00	10.00
1871	1	15	10.00	10.00	10.00
1871	1	16	10.00	10.00	10.00
1871	1	17	10.00	10.00	10.00
1871	1	18	10.00	10.00	10.00
1871	1	19	10.00	10.00	10.00
1871	1	20	10.00	10.00	10.00
1871	1	21	10.00	10.00	10.00
1871	1	22	10.00	10.00	10.00
1871	1	23	10.00	10.00	10.00
1871	1	24	10.00	10.00	10.00
1871	1	25	10.00	10.00	10.00
1871	1	26	10.00	10.00	10.00
1871	1	27	10.00	10.00	10.00
1871	1	28	10.00	10.00	10.00
1871	1	29	10.00	10.00	10.00
1871	1	30	10.00	10.00	10.00



